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60-Inch Water Main Failure in Chevy Chase and PCCP Program Update

April 8, 2013

What is the Problem?

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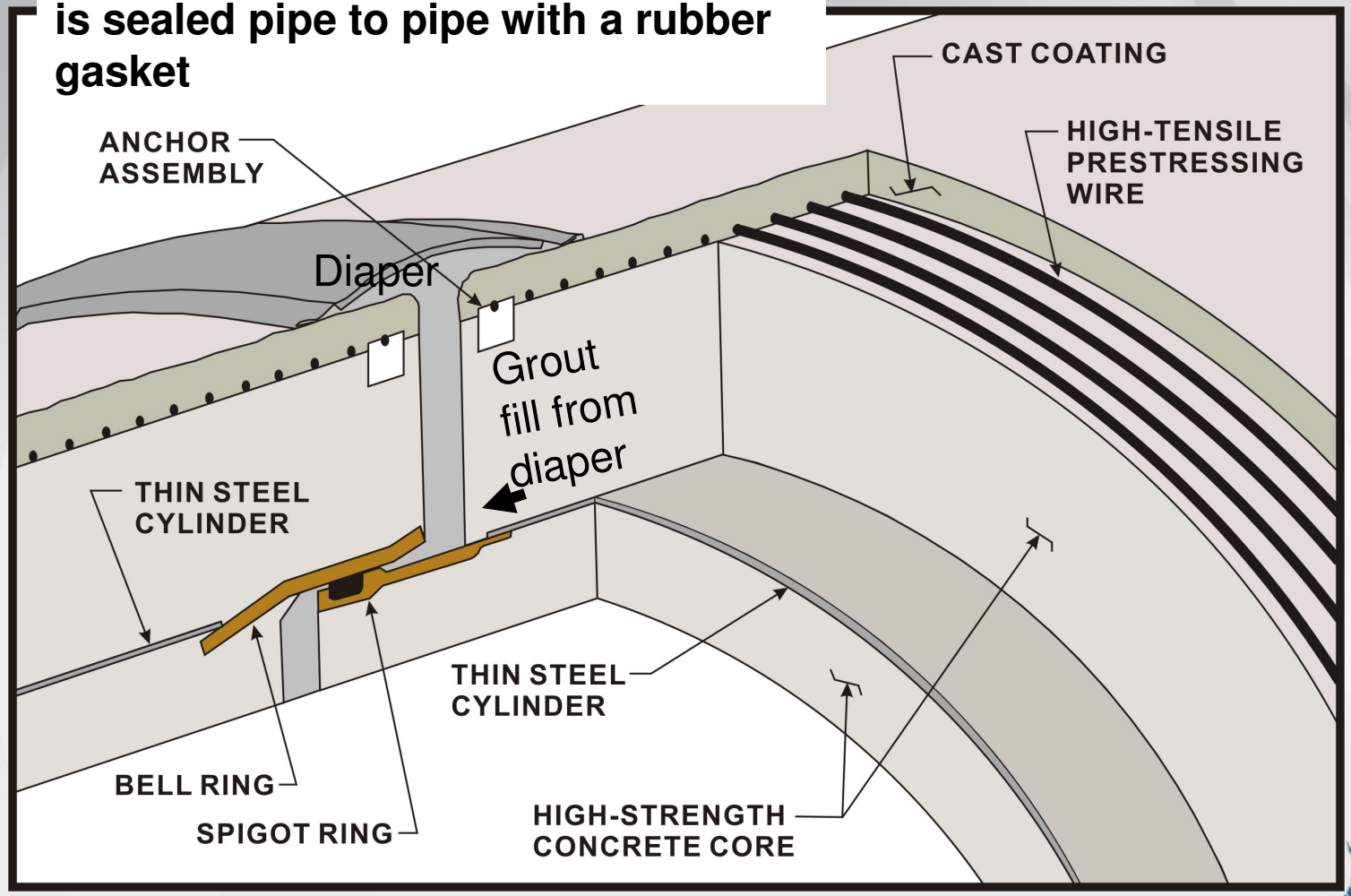
PCCP Section

PCCP is a composite structure made up of high strength concrete, extremely high strength steel wire, a thin low strength steel cylinder and is sealed pipe to pipe with a rubber gasket



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Failed 48-Inch Summer 2008

Shown is Side of Cylinder Rupture.

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Failed 66-Inch December 2008

Failure is the bottom hole, not the top one & near the joint…

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Failed 42-Inch January 2009

Note Failed Wires Showing Corrosion

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Failed 54-Inch January 2011

After cutting the pipe apart - failure is the second hole from the left

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Failed 60-Inch March 2013

Pipeline Runs Approximately Parallel to Connecticut Avenue – Failure Pointed Away From the Road

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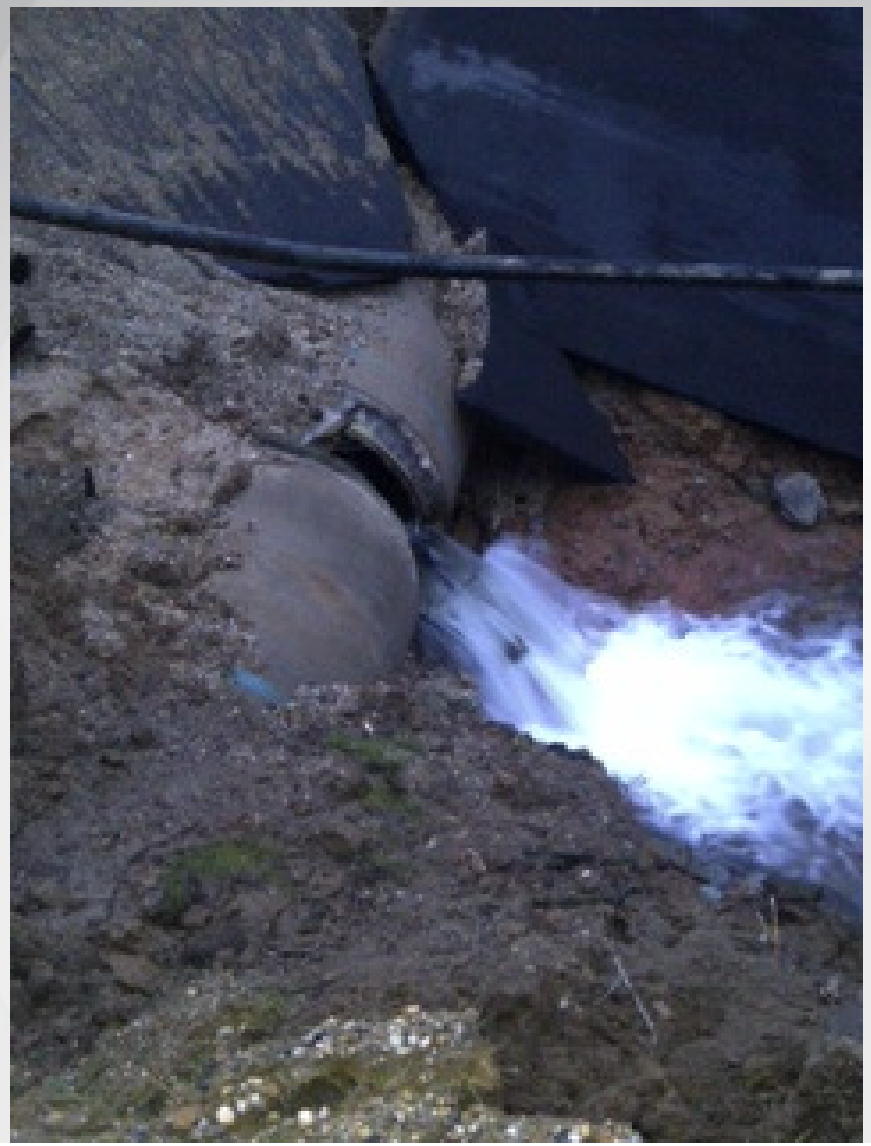
Failed 60-Inch March 2013



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Failed 60-Inch March 2013

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Timeline

Monday, March 18

- 13:03 Citizen Reports Water Bubbling Near 8101 Connecticut Avenue
- 13:20 Information Relayed to Inspector
- 13:50 Inspector Determines Water Coming from Valve Vault
- 14:30 Crew Arrives and Pumps Out Vault – Decided to Repair Next Day
- 19:40 Montgomery Main Zone Tanks Began Falling
- 20:01 Received Police Report
- 20:30 Crew Dispatched to Isolate Main
- 21:00 MC Fire Board Notified to Expect Fire Flow Issues
- 21:30 Gas & Electric Utilities Arrived
- 22:18 Alert Montgomery Sent Message About the Break
- 22:30 PGC Fire Board Notified of Impending Fire Flow Issues

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Timeline

Tuesday, 19 March

- 02:00 Isolated Water Main
- 03:25 WSSC Notification of Water Main Shutdown
- 04:00 Montgomery Main Zone Tanks Began Refilling
- 04:49 WSSC News Release About Water Use Restrictions
- 05:30 Alert Montgomery Sent Message About Water Use Restrictions
- 07:00 Issued NTP to Emergency Contractor
- 09:00 Damaged Electrical Overhead Line Relocated
  Damaged Gas Line Relocated
- 14:00 Excavation of Water Main Began
  Installed New 10” Valve on 10” Main to Renew Water Service

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Timeline

Wednesday, 20 March

- 18:00 Broken Pipe Removed – Began Installing New Section

Thursday, 21 March

- 18:00 Repair Completed – Awaiting 12-hour Cure Time for Grout

Friday, 22 March

- 04:00 Began to Refill Water Main
- 09:00 Water Main Charged – Began Flushing
- 21:00 Water Samples Taken for 18-hour Bacterial Test

Saturday, 23 March

- 16:00 Water Tested Good – Began to Open Valves
- 20:00 All Valves Open and Pipeline Returned to Service

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System Status Complications (at the time of the break)

Other Transmission Mains Out of Service

- Potomac WFP to Tuckerman Lane 96” MC Main/PGC Main/High Zones – PCCP Inspection
- Germantown 48/66” MC High Zone – PCCP Inspection and 54” Valve Installation
- Patuxent WFP 42” PGC PGC Main Zone – SHA ICC/Contee Road Construction

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What Do We Know About This Failure?

- The Pipe was last inspected in the FY 10 Program
- AFO was Installed in the FY 10 Program
- Since Then There Have Been Six Wire Breaks Recorded – All On the Opposite End from the Break
- Recorded Wire Break Activity Was Not a Concern
- There Were No Wire Breaks Recorded at the Failure Location Before the Failure
- A Leak Was Reported Surfacing at This Location
- The Pipe Failed Catastrophically
- The Pipe Geometry is Atypical
- Final Forensic Report Due EO June

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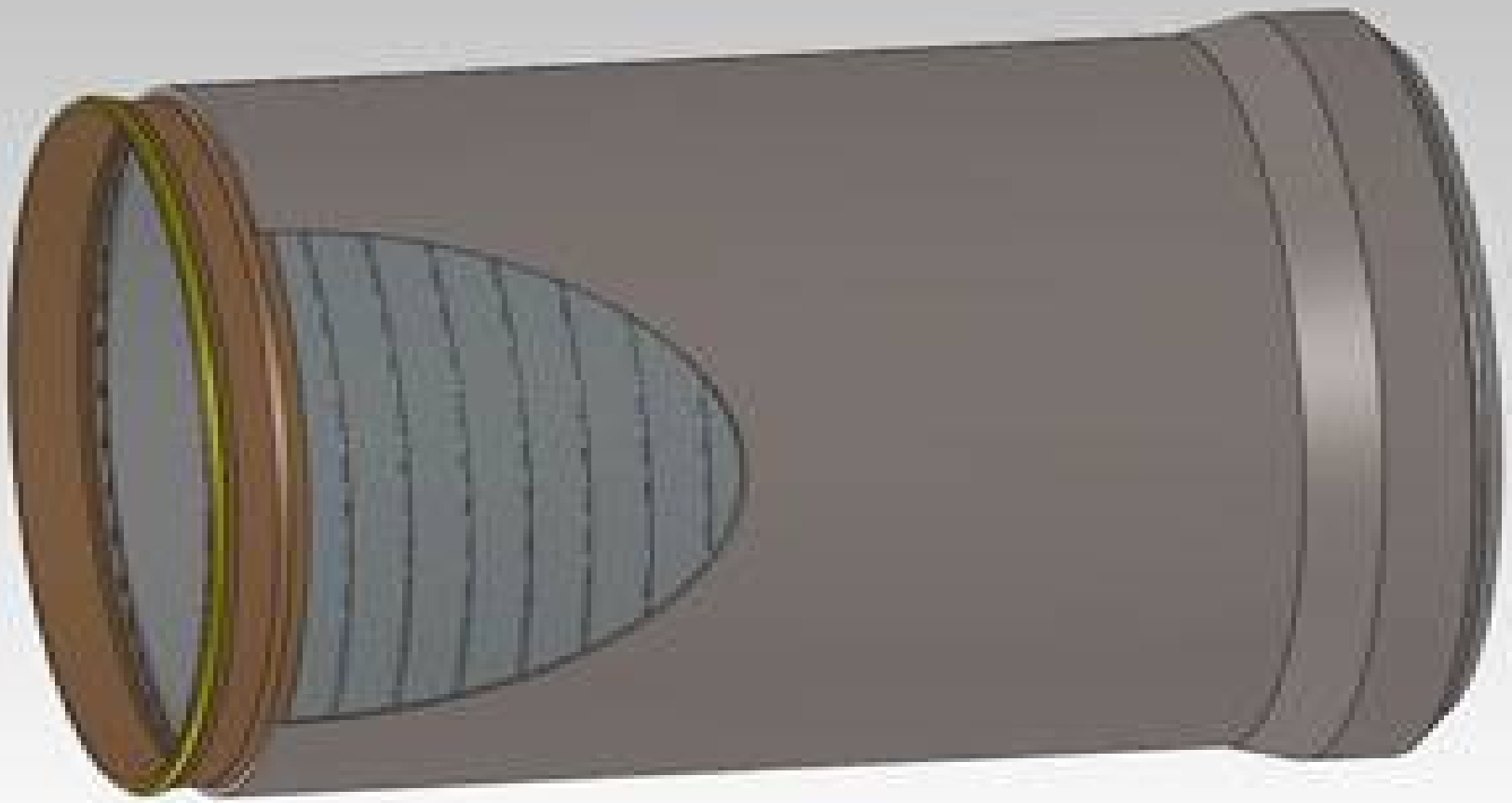
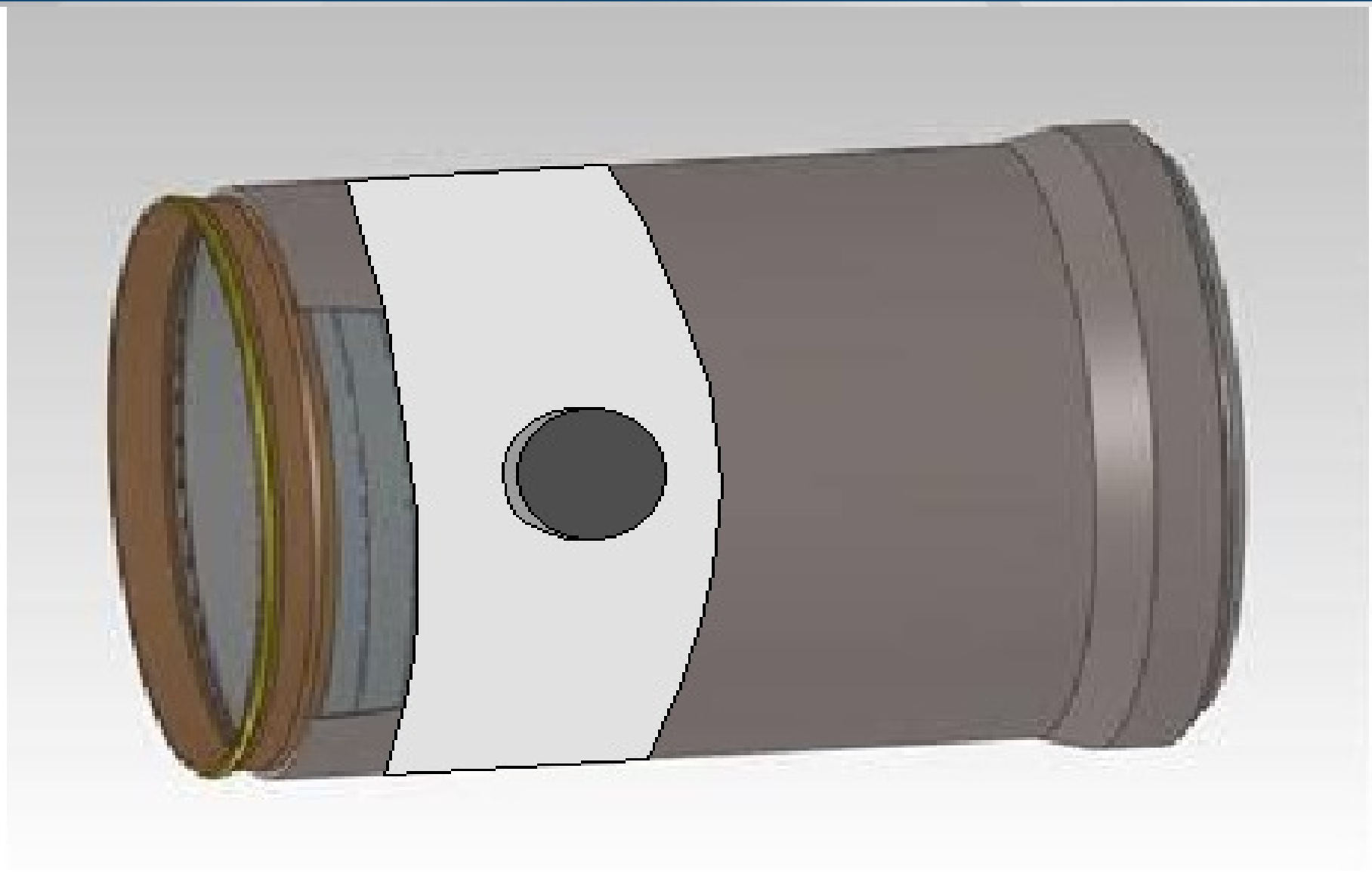
Failed Pipe Segment Geometry



Failed Pipe Segment Geometry



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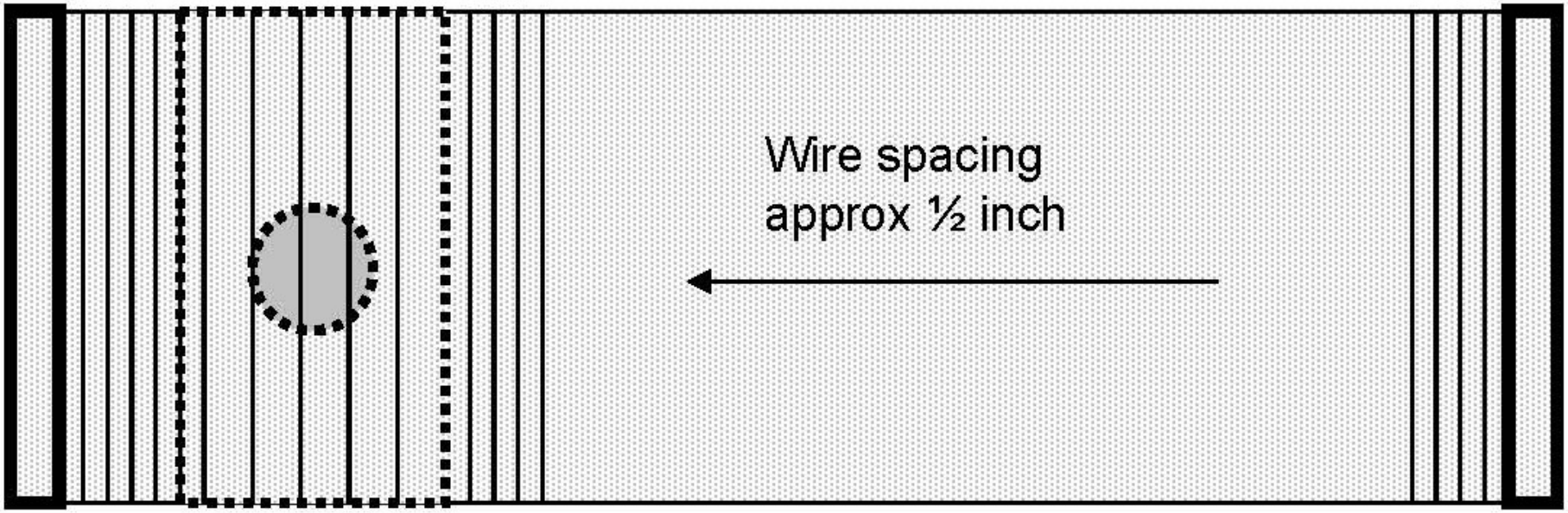

Can We Just Replace Them?

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The Cost to Replace Critical Lines is Prohibitive

pipe size	mileage of PCCP per pipe size	cost of replacement construction	engineering cost	total cost of replacement
16	71.9	$153,371,328	$30,674,266	
20	35.1	$132,972,840	$26,594,568	
24	64.5	$251,248,140	$50,249,628	
30	34.2	$238,631,184	$47,726,237	
36	37.7	$330,831,072	$66,166,214	
42	30.3	$274,532,544	$54,906,509	
48	18.3	$171,024,480	$34,204,896	$205,229,376
54	8.7	$84,097,332	$16,819,466	$100,916,798
60	21.9	$257,310,108	$51,462,022	$308,772,130
66	12.8	$153,584,640	$30,716,928	$184,301,568
72	4.6	$56,178,144	$11,235,629	$67,413,773
78	1	$14,802,480	$2,960,496	$17,762,976
96	10.7	$293,129,496	$58,625,899	$351,755,395
	351.7	$2,411,713,788	$482,342,758	**$2,894,056,546**

48” – 96”

$1.23B

Excessive Downtime to Replace Critical Lines is Unavoidable

48” & Bigger

Over 115 Years Downtime

2/3 Mile Per Year to Replace w/ Steel & Cathodic Protection

For Approximately 2% of Sections

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So What Are We Doing?

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PCCP Inspection Program

- Mid-1990's--Sonic/Ultrasonic Pulse Echo was adapted to PCCP and added to the Program--identifies micro-cracking and concrete out of compression.
- 2001--Electromagnetic (RFEC/TC) testing was added to the Program--estimates number of broken pre-stressing wires in each pipe section
- Early 2007, permanent Acoustical Fiber Optic (AFO) monitoring first installed-- monitors wire breaks following a baseline condition assessment
- In late 2008, acoustical leak detection methods were added to be performed prior to dewatering for the inspections

PCCP Inspection Program

- WSSC has a total of 145 miles of Larger Pre-stressed Concrete Cylinder Pipe (PCCP) Water Mains including:
  - **77 miles – 48" and Greater**
  - **68 miles – 36" and 42"**
- Program focused on mains 48-inch and greater--considered a higher risk due to their diameter, operational criticality, and highest consequence of failure
- Current program is adding 36 and 42-inch lines

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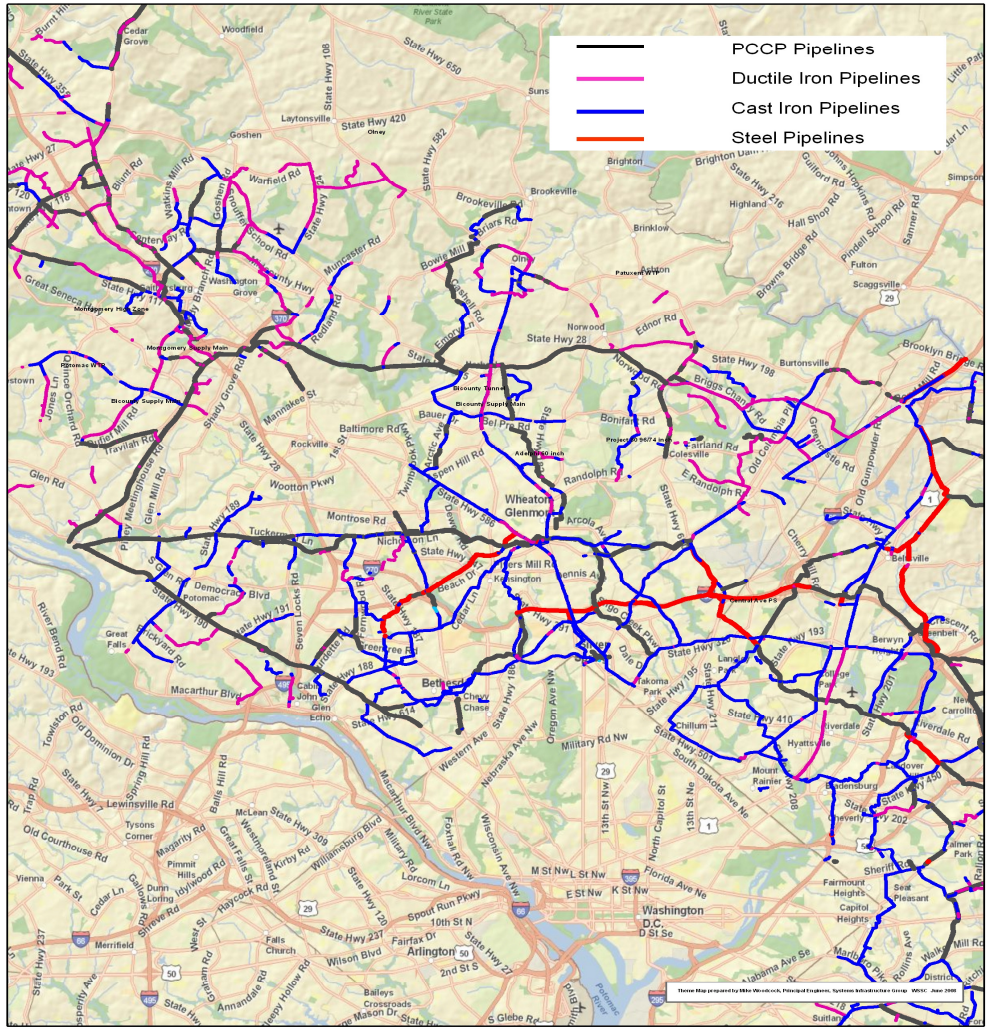
PCCP Inspection Program

- Inspection includes visual and sounding, sonic/ultrasonic, electromagnetic survey, acoustical leak testing, long term acoustical monitoring
- Establishes baseline condition, locates leaks, identifies needed repairs/replacements and planning for long term capital replacements
  - Engineering analysis done to determine if deteriorated pipes require replacement or can be repaired with carbon fiber internally or tendons externally
  - Permanent acoustical monitoring listens for additional wire break activity as early warning sign and establish rate of deterioration
- Inspections take 1-2 months to perform depending upon pipeline length
  - Shut down and dewater pipeline during colder months, inspect and repair before July when demand increases
  - During higher water main break season the Maintenance Staff has to closely plan as their resources are already taxed with responses to water main breaks

Transmission Mains



- Main Water Conduits
- Some Redundancy
- Limits on Number That Can Be Out at Once

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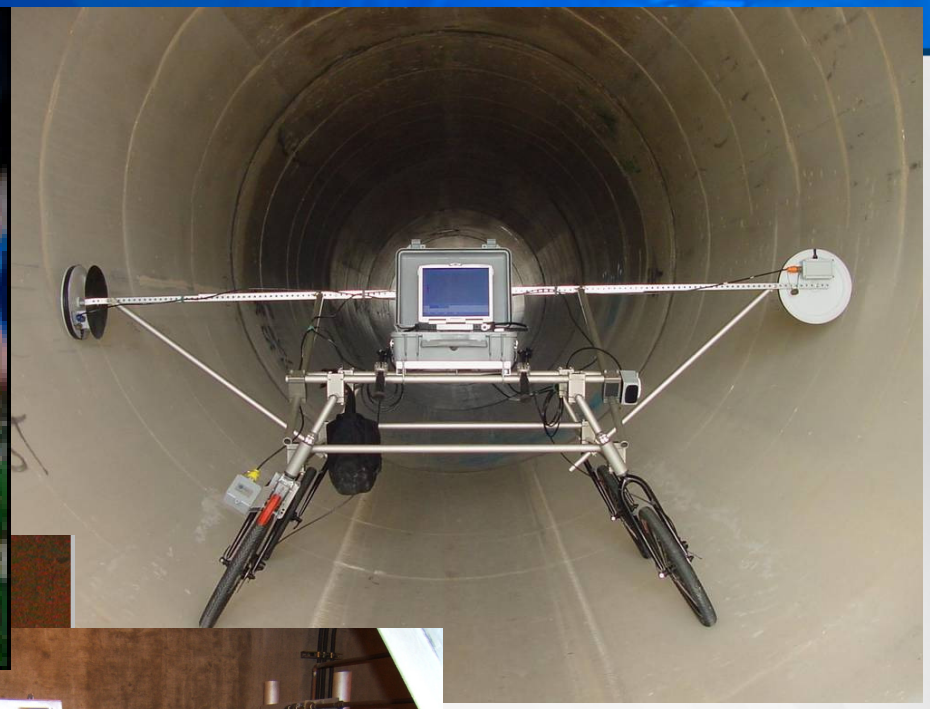
Inspection Technologies



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Acoustical Fiber Optic Cable Monitoring

- What Does it Do?
  - Monitors Acoustical Wire Break Activity
  - Coupled with Baseline Determines Rate of Deterioration
  - Used to Prioritize/Adjust PCCP Inspection Schedule

- What Does it Not Do?
  - Prevent Deterioration
  - Monitor for Pipe Leaks
  - Guarantee a Pipe Will Not Fail

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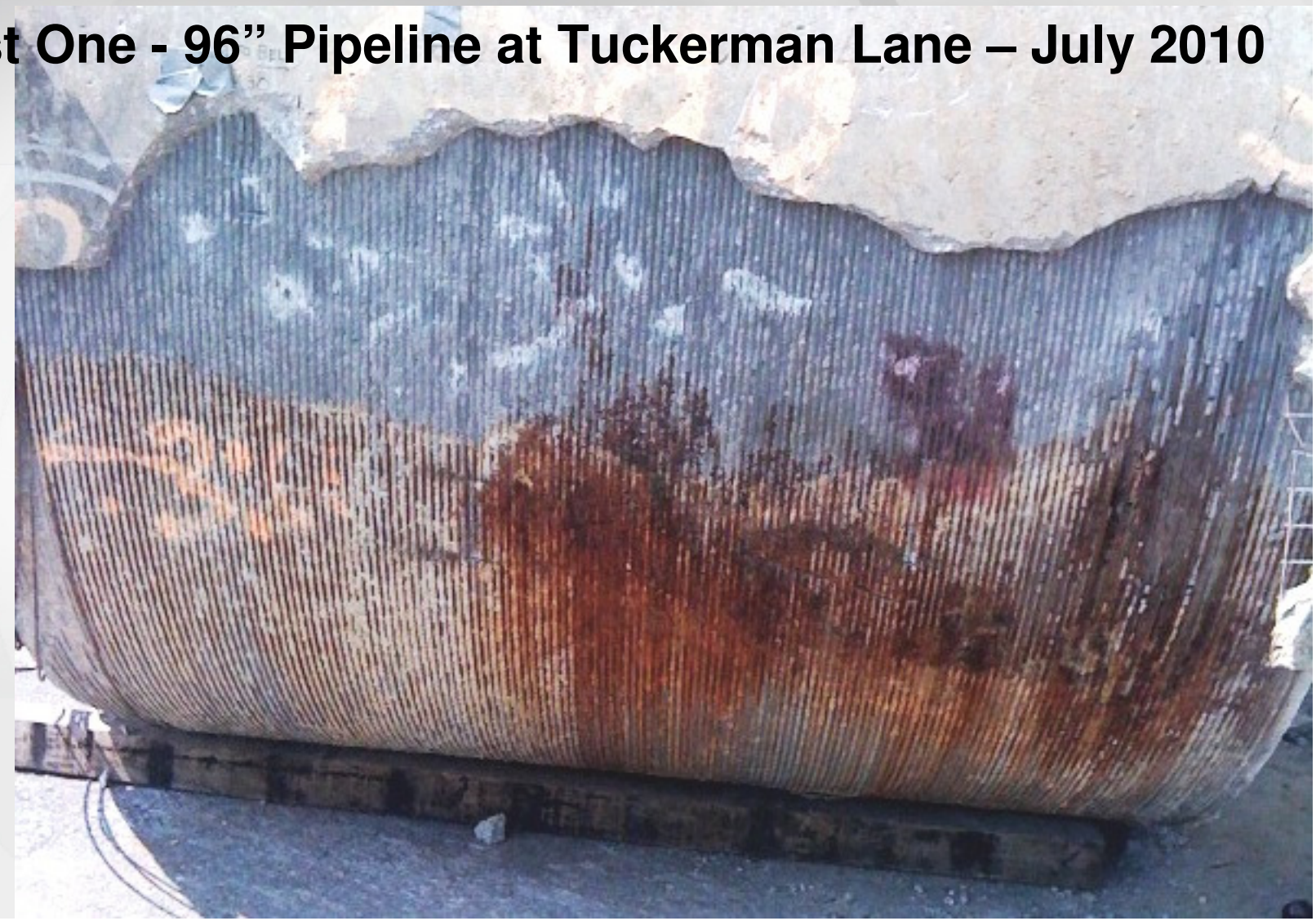
Does it Work?

The First One - 96” Pipeline at Tuckerman Lane – July 2010



Twelve Others in FY 11/12/13 Programs

- Repaired 6 - 54” Sections Springdell Place (June 2011)
- Replaced 1 – 96” Section at Ridge Mist Terrace (January 2012)
- Repaired 4 – 66” Sections at Nevis Road (November 2012)
- Will Repair 1 – 96” Section at Big Piney Way (May 2013)

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Sustainable PCCP Program

- A Sustainable PCCP Inspection and Condition Assessment Program is Critical to the Mission of WSSC

  - ✓ Ensures timely inspection and repair of deteriorated pipe sections
  - ✓ Provides safer, more reliable water supply
  - ✓ Helps ensure the pipelines reach their intended useful life
  - ✓ Provides condition assessment for long term capital planning

- Program Must Remain a Top Budget Priority and Funded Annually to Assure Public Safety and Reliability of the Water Supply

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Questions

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